CLAIMS

What is claimed is:

1. A machine tool monitoring fixture comprising,

a body,

first, second, and third blocks mounted on said body at first, second, and third angular positions respectively along an arc circumscribed by a radius about an axis of rotation, and

said first, second, and third blocks having first, second, and third flat surfaces respectively,

said first, second, and third flat surfaces having first, second, and third normals parallel to said axis of rotation.

2. A fixture as claimed in claim 1 wherein said first, second, and third flat surfaces are co-planer.

3. A fixture as claimed in claim 2 wherein said body comprises parallel first and second walls, and a third wall disposed between, normal to, and connected to said first and second walls, and wherein said first, second, and third blocks are mounted on one of said first and second parallel walls.

4. A fixture as claimed in claim 3 further comprising first and second recesses in said first and second walls respectively.

5. A fixture as claimed in claim 4 wherein said first, second, and third blocks are mounted on an outer surface of one of said first and second parallel walls, said outer facing away from an other of said first and second parallel walls.

6. A fixture as claimed in claim 5 further comprising a base to which said first, second, and third walls are attached.

7. A fixture as claimed in claim 6 wherein said recesses have arcuate edges circumscribed about said axis of rotation.

8. A fixture as claimed in claim 7 further comprising a CNC pallet to which said base is mounted.

9. A monitoring system for monitoring alignment of a spindle trunnion axis of a computer numerically controlled (CNC) machine, said system comprising:

a probe to measure locations of features on a machine tool monitoring fixture, said probe mounted in a tool holder mounted on a spindle of the machine;

control means for moving said spindle mounted probe;

a machine tool monitoring fixture comprising:

a body,

first, second, and third blocks mounted on said body at first, second, and third angular positions respectively along an arc circumscribed by a radius about an axis of rotation, and

said first, second, and third blocks having co-planer first, second, and third flat surfaces with a normal parallel to said axis of rotation; and

measuring, recording, and display means for measuring, recording, and displaying location data probed by said probe against said flat surfaces, said means effective to display the location data as a deviation from a baseline measurement.

10. A system as claimed in claim 9 further comprising means for providing instructions for an operator to follow to correct misalignment of the spindle trunnion axis based on the location data.

11. A system as claimed in claim 9 wherein said body comprises parallel first and second walls, and a third wall disposed between, normal to, and connected to said first and second walls.

12. A system as claimed in claim 11 further comprising first and second recesses in said first and second walls respectively.

13. A system as claimed in claim 12 wherein said first, second, and third blocks are mounted on an outer surface of one of said first and second parallel walls, said outer facing away from an other of said first and second parallel walls.

14. A system as claimed in claim 13 further comprising a base to which said first, second, and third walls are attached.

15. A system as claimed in claim 12 wherein said recesses have arcuate edges circumscribed about said axis of rotation.

16. A system as claimed in claim 14 further comprising a CNC pallet to which said base is mounted.

17. A method of monitoring the condition of a trunnion axis of a computer numerically controlled (CNC) machine using a spindle mounted probe which rotates about the trunnion axis, said method comprising:

a plurality of a series of steps, each of said series comprising the following steps;

A) mounting a monitoring fixture on a rotary table of the machine and presenting the fixture to the spindle mounted probe,

B) probing at least first, second, and third probing points on first, second, and third probing surfaces respectively on a monitoring fixture, the probing surfaces having parallel normals substantially parallel to the trunnion axis wherein the first, second, and third probing points are at three angular positions along an arc circumscribed by a radius about the trunnion axis, and

C) recording location readings for each of the points;

establishing baseline position locations using a first of the plurality of a series of steps A-C; and

monitoring differences from the baseline position locations and subsequent position locations from others of the plurality of a series of steps A-C

after the first of the plurality.

18. A method as claimed in claim 17 further comprising monitoring the differences and generating an alert message if the differences exceed specified tolerances.

19. A method as claimed in claim 17 further comprising using a monitoring fixture having first, second, and third probing blocks upon which lie the first, second, and third probing surfaces respectively.

20. A method of monitoring the condition of a trunnion axis of a computer numerically controlled (CNC) machine using a spindle mounted probe which rotates about the trunnion axis and a monitoring fixture having a body; first, second, and third blocks mounted on the body at first, second, and third angular positions respectively along an arc circumscribed by a radius about an axis of rotation; the first, second, and third blocks having first, second, and third flat surfaces respectively; and the first, second, and third flat surfaces having first, second, and third normals parallel to the axis of rotation; said method comprising:

monitoring trunnion axis tracking using a plurality of a series of steps, each of said series comprising the following steps;

A) mounting a monitoring fixture on a rotary table of the machine and presenting the fixture to the spindle mounted probe,

B) probing at least first, second, and third

probing points on first, second, and third probing surfaces respectively on a monitoring fixture, the probing surfaces having parallel normals substantially parallel to the trunnion axis wherein the first, second, and third probing points are at three angular positions along an arc circumscribed by a radius about the trunnion axis, and

C) recording location readings for each of the points;

establishing baseline position locations using a first of the plurality of a series of steps A-C; and

monitoring differences from the baseline position locations and subsequent position locations from others of the plurality of a series of steps A-C after the first of the plurality.